Water mist fire suppression device

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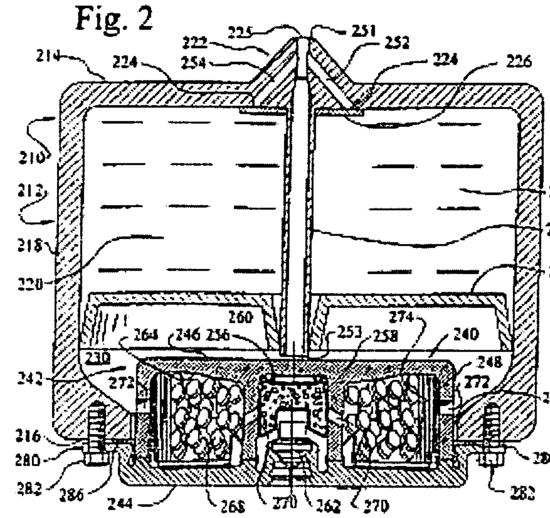
A fire suppression device (210) includes an enclosure (212) having opposite end walls (214, 216) and a side wall (218) joining the end walls to define a hollow chamber (220) within the enclosure. An atomizing nozzle (222) is operatively coupled to a first of the end walls and has an entrance portion (224) adjacent the chamber and an exit (225) in communication with the atmosphere outside of the enclosure. A frangible barrier (226) is interposed between the nozzle entrance portion (224) and the chamber and is responsive to a predetermined pressure for fracturing to permit communication between the nozzle and the chamber. A piston (232) is located between the end walls and engaged about an inner periphery of the side wall (218) to divide the chamber into two sections. A first of these sections (228), between the piston and the first end wall (214), is filled with a quantity of water and comprises a major fractional portion of the volume of the chamber. The piston is slidably moveable relative to the side wall (218) in the direction of the first end wall (214) in response to a force exerted upon the piston for exerting pressure upon the quantity of water for initially fracturing the frangible barrier and for thereafter delivering a water mist through the atomizing nozzle. A gas generator (240) communicates with the second section (230) for delivering high pressure gas to exert the force upon the piston, causing a fine mist to flow from the nozzle. As a variation, a conduit (250) may extend from the nozzle to the second section, and the nozzle may include venturis (252, 254) extending between the first section and the conduit. The generated

Fig. 2



gas will flow through the conduit to further draw the water via venturi effect.

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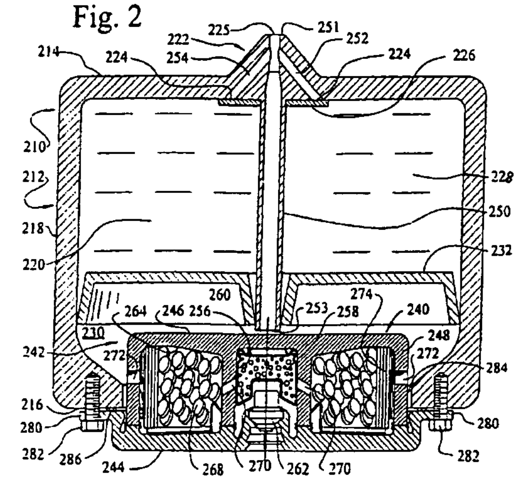
(54) **Water mist fire suppression device**

(57) A fire suppression device (210) includes an enclosure (212) having opposite end walls (214, 216) and a side wall (218) joining the end walls to define a hollow chamber (220) within the enclosure. An atomizing nozzle (222) is operatively coupled to a first of the end walls and has an entrance portion (224) adjacent the chamber and an exit (225) in communication with the atmosphere outside of the enclosure. A frangible barrier (226) is interposed between the nozzle entrance portion (224) and the chamber and is responsive to a predetermined pressure for fracturing to permit communication between the nozzle and the chamber. A piston (232) is located between the end walls and engaged about an inner periphery of the side wall (218) to divide the chamber into two sections. A first of these sections (228), between the piston and the first end wall (214), is filled with a quantity of water and comprises a major fractional portion of the volume of the chamber. The piston is slidably moveable relative to the side wall (218) in the direction of the first end wall (214) in response to a force exerted upon the piston for exerting pressure upon the quantity of water for initially fracturing the frangible barrier and for thereafter delivering a water mist through the atomizing nozzle. A gas generator (240) communicates with the second section (230) for delivering high pressure gas to exert the force upon the piston, causing a fine mist to flow from the nozzle. As a variation, a conduit (250) may extend from the nozzle to the second section, and the nozzle may include venturis (252, 254) extending between the first section and the conduit. The generated gas will flow through the conduit to further draw the water via venturi effect.

Fig. 2



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Description

This invention is directed to a novel and improved fire suppression device, and more particularly to such a device which produces a water mist, and is self-contained. Still more particularly, the fire suppression device may use an inert gas generator apparatus to facilitate the formation and/or propulsion of a water mist.

Heretofore, water-based indoor fire suppression has generally been in the form of water sprinkler systems which generally operate at ordinary building or municipal water pressure. These systems depend upon distributing a plurality of sprinkler heads around an area to be protected. Such systems can be relatively complex and expensive, requiring piping interconnecting the sprinkler heads and running to a suitable source of water, which is normally at the pressure provided in the facility or building, or the municipal or other provider water pressure, that is, a relatively low pressure. Such sprinkler systems when activated deliver large quantities of water at relatively low pressures.

However, in many applications the distribution of a relatively large quantity of water in the event of fire is considered undesirable. This may be due to the sensitivity of various types of equipment to large quantities of water and/or the high probability of damage to such equipment in response to a relatively large amount of water which would be applied by such a sprinkler system in the event of fire. Such equipment may be found for example in computer rooms, turbine rooms, bank vaults, and the like. Many industrial processes utilize equipment maintained at elevated temperatures which could be damaged by rapid cooling due to application of a large quantity of water.

In these latter types of applications, some non-water-based fire protection system is often used, such as chemical-based fire extinguishers (often halon) which must be utilized by personnel in the event of fire, or less commonly, some other distribution system in which a chemical fire suppressant such as halon is applied. However, halon is no longer manufactured because of its high ozone depletion potential.

A more recently emerging technology in fire protection is to use some form of water mist system. Such systems use relatively small amounts of water in the form of a fine mist to extinguish a fire, rather than the relatively large volume of water that an ordinary sprinkler system would typically distribute or apply. A water mist operates to extinguish a fire by at least two different mechanisms, namely, by extracting heat and by displacing oxygen. Such systems use relatively small amounts of water in the form of a fine mist of very small (e.g., 50 microns) water droplets to extinguish fires. As mentioned, such a water mist can extinguish a fire by using several different mechanisms. First, the rapid evaporation of the small water droplets extracts heat, and secondly, oxygen is displaced due to the steam displacement of air, as water droplets are turned to steam. Also, the amount of heat radiated from a flame to the unburned fuel is decreased.

These water mist systems are useful in areas where large volumes of water are not available, or where large amounts of water could cause undesirable damage to equipment, for example, computer rooms, bank vaults, turbine rooms etc., as mentioned above. Rather than using ordinary nozzles and water at available pressure, such water mist systems generally utilize atomizing nozzles which require a supply of water at relatively high pressure to produce the desired mist.

Such water mist systems therefore can be much like conventional sprinkler systems, in that they can require extensive piping to provide water to the nozzles. In addition, these systems, unlike conventional sprinkler systems, require pumps and high pressure connections, fittings, conduits and the like to maintain the required water pressure. Thus, such systems can be relatively complex and be difficult and expensive to install, maintain and/or modify if desired. For example, the modification of such a system to protect different equipment at different locations, to add locations, or the like can be relatively complicated, expensive and time-consuming.

Accordingly, it is a general object of the invention to provide a novel and improved water mist fire suppression device which does not require a separate remotely located high pressure water source, or a system of interconnected piping, pumps or the like.

A related object is to provide a fire suppression device in accordance with the foregoing object which may be relatively easily placed at, or moved to, a location appropriate for servicing an area where fire protection is desired.

Yet another object is to provide a fire suppression device in accordance with the foregoing object which is self-contained and can be provided in diverse sizes and configurations for use in diverse applications.

Briefly, and in accordance with the foregoing objects, a fire suppression device comprises an enclosure having opposite end walls and a side wall joining said end walls to define a hollow chamber within said enclosure; an atomizing nozzle operatively coupled to a first of said end walls and having an entrance portion adjacent said chamber and an exit portion in communication with the atmosphere outside of said enclosure; a frangible barrier interposed between said nozzle entrance and said chamber and responsive to a predetermined pressure for fracturing to permit communication between said nozzle and said chamber; piston means located between said end walls and engaged about an inner periphery of said side wall to divide said chamber into two parts comprising a first section between said piston means and said first end wall to be filled with a quantity of water and a second section between said piston means and the other end wall, said first section comprising a major fractional portion of the volume of said chamber; said piston being slidably moveable relative to said side wall in the direction of said first end wall in

response to a force exerted upon said piston means for exerting pressure upon said quantity of water for initially fracturing said frangible barrier and for thereafter delivering a water mist through said atomizing nozzle, and drive means for exerting said force upon the piston means.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The organization and manner of operation of the invention, together with further objects and advantages thereof may best be understood by reference to the following description, taken in connection with the accompanying drawings in which like reference numerals identify like elements, and in which:

Fig. 1 is an elevation in section of a fire suppression device in accordance with the invention;
Fig. 2 is an elevation in section showing a second embodiment of a fire suppression device in accordance with the invention;
Fig. 3 is an elevation in section showing an alternate form of an inert gas generator device which may be utilized in the fire suppression device of the invention; and
Fig. 4 shows yet another form of inert gas generator device which may be utilized in the invention.

Referring now to the drawings and initially to Fig. 1, a fire suppression device in accordance with the invention is designated generally by the reference numeral 10. The device 10 includes an enclosure 12 which has opposite end walls 14, 16 and a side wall 18 which joins the end walls together to define a hollow chamber 20 within the enclosure. The end walls 14, 16 may be generally circular in shape and the side wall 18 may be cylindrical and continuously formed with and between the respective end walls 14, 16. However, other shapes, configurations and means of joining the respective walls together to form the chamber 20 may be utilized without departing from the invention.

Coupled to the end wall 14 is an atomizing nozzle 22 which has an entrance portion 24 adjacent the chamber 20 and an opposite or exit portion 25 which is in communication with the atmosphere outside of the enclosure 12. A frangible barrier such as a burst foil 26 is interposed between the nozzle entrance portion 24 and the chamber 20. Preferably, the burst foil overlies the nozzle entrance portion 24 where it meets or intersects with the inner surface of the end wall 14. This frangible barrier or burst foil 26 is responsive to a predetermined force or pressure exerted thereupon for fracturing to thereby permit communication between the nozzle 22 and the chamber 20.

The chamber 20 is divided into a first or upper section 28 and a second or lower section 30 by a piston 32 which is located at a predetermined distance between the respective end walls 14, 16 and which is engaged about an inner periphery of the side wall 18. Preferably, this engagement is such that water cannot pass around the edges of the piston 32. The piston 32 is slidably moveable relative to the side wall 18 and is moveable generally in the direction toward the end wall 14 in response to a pressure exerted upon the piston at its side opposite the wall 14. Thus, the piston 32 effectively divides the chamber into the first section 28 located between the piston 32 and the end wall 14 and the second section 30 located between the piston 32 and the end wall 16. In its initial condition and before any movement of the piston 32 relative to the respective end walls 14, 16, the first section 28 of the chamber 20 comprises a major fractional part of the chamber, that is, it is much larger in volume than the second section 30, as defined by the piston 32. The first section 28 of the chamber 20 is filled with a quantity of water. Thus, when the piston 32 is forced upwardly in the direction of end wall 14, the water in the first section 28 will exert a pressure upon the burst foil 26, causing the burst foil to break and the water to flow through the atomizing nozzle 22 to create a water mist.

Referring now to the second section 30, a driver 40 is located or mounted in, or at least in communication with, this second section 30 of the chamber 20. This driver produces the necessary force or pressure to propel the piston toward the end wall 14.

Preferably, the driver 40 comprises a gas generator. This gas generator is operative for generating a quantity of gas, and preferably of an inert gas, upon the occurrence of preselected external stimuli, and for releasing this quantity of gas into the second section 30 so as to exert a pressure upon the piston 32 to cause the release of a water mist at the atomizing nozzle 22 as just described. This external stimulus may take the form of a suitable electrical signal produced by a selected sensor, such as a heat sensor, smoke detector, or the like, which does not form a part of the invention and is not illustrated herein. The form of sensor or transducer utilized to activate the gas generator may take any suitable form without departing from the invention.

Fig. 2 illustrates a somewhat modified embodiment of a fire suppression device, designated generally by reference numeral 210. In many respects, the device 210 is similar to the device 10 illustrated and described above with reference to Fig. 1. Therefore, similar reference numerals will be utilized to designate similar parts and components of the fire suppression device 210. In similar fashion to the embodiment of Fig. 1, the fire suppression device 210 has an enclosure 212 formed of a first wall 214, a second wall 216 and a side wall 218 which define a chamber 220. An atomizing nozzle 222 has an inlet 224 and an outlet 225. Departing from the embodiment of Fig. 1, the atomizing nozzle 222 is here illustrated as an air assist atomizing nozzle. The chamber 220 is split into a first section 228 and a second section 230 by a slidably mounted piston 232.

Departing from the embodiment of Fig. 1, the air assist atomizing nozzle utilizes an elongate tubular conduit

250 which extends between the nozzle 222 at a first end 251 and the second section 230 of the chamber at a second end 253 for delivering a portion of a gas generated by a gas generator 240 to the nozzle 222 for propelling water therethrough. In this regard, the nozzle 222 includes a plurality of diagonally inclined passageways or venturis 252, 254, each of which has one end forming the nozzle inlet 224 adjacent to the first section 228 of the chamber and an opposite end intersecting the interior of the tubular conduit 250, just below the outlet 225 which generally coincides with the end 251 of the tubular conduit 250.

A frangible barrier or burst foil 226 which operates in the same fashion as burst foil 26 is interposed between the inlets 224 to the venturis 252, 254 and the chamber portion 228. In this embodiment, the burst foil 226 is a generally flat, annular member which surrounds the tubular conduit 250, so as to initially overlie the entrance 224 of each of the plurality of venturis 252, 254. It will be understood that while two such venturis have been illustrated herein, only a single such venturi, or more than two such venturis, may be provided without departing from the invention. Similarly, the burst foil 226 may be provided in a different configuration or as a plurality of individual members, one for each inlet 224 without departing from the invention. In the illustrated embodiment, it will be noted that the internal diameter of the tubular conduit 250 is narrowed somewhat at its upper portion, just prior to the point of intersection with the passageways 252,254.

Also, to accommodate the tubular conduit 250, the piston 232 is provided with a central through opening which is arranged with a bent back edge, similar to its bent back outer edges, as illustrated also in Fig. 1. These bent back edges enable the piston to slidably engage and maintain a water seal against both the outer wall of the tubular conduit 250 and the inner surface of the side wall 218. This facilitates the sliding motion of the piston 232 in the direction of the first wall 214 in response to the pressure exerted thereupon by the release of gas from the gas generator 240.

Turning now to the gas generator 240, as mentioned above, it preferably comprises an inflator device of the type generally utilized for an inflatable vehicle occupant restraint device or air bag. Generally speaking, this inflator 240 includes a housing 242 which has a generally circular bottom wall 244 and a generally circular top wall 246 and a generally cylindrical outer peripheral wall 248 extending between and operatively joining the top and bottom walls 246 and 244 to form a housing. Spaced radially inwardly of the outer peripheral wall 248 is a generally cylindrical internal wall 256 which extends between and joins the top wall 246 and bottom wall 244. Typically, the top wall 246, outer wall 248 and internal wall 256 are formed as a unit and are joined to the bottom wall 244 by a process such as inertia welding. In this regard, it will be seen that the bottom wall 244 has a pair of generally annular, short concentric upwardly extending surfaces or rings which respectively align with and engage the outer wall 248 and internal wall 256.

The walls 248 and 256 define a pair of chambers, including a cylindrical ignition chamber 258 inside of the wall 256, with the chamber 258 being partially filled with an ignition material 260, and also accommodating an initiator or squib 262. Radially surrounding the wall 256 and inside of the outer wall 248 is a generally annular generator chamber 264 which houses a quantity of a pyrotechnic gas generant material 268. This material may have various compositions such as an azide, and may be in many forms, a tablet form being here illustrated for purposes of description. The internal wall 256 includes a plurality of ignition ports 270 which extend between the ignition and generator chambers 258, 264 to permit the hot gases from the ignition material 260 to flow into the generator chamber 264 and cause the generant material 268 to generate a quantity of gas. Similarly, the outer wall 248 is provided with a plurality of gas exit ports 272 through which the generated gas exits the gas generator 240 into the second section 230 to thereby exert a pressure upon the piston and urge the piston in the direction of the first wall 214.

Intermediate the gas generant material 268 and the inner surface of the outer wall 248 in which the exit ports 272 are located, there is interposed a filter structure designated generally by the reference numeral 274 for filtering and cooling the generated gas prior to its exit through the ports 272. The filter is of a generally cylindrical or tubular form.

Without departing from the invention, gas generator structures of different configuration may be utilized. For example, a structure in which the exit ports 272 are provided in the top wall 246, and wherein the filter structure or assembly is a generally annular disc-like member interposed between the gas generant material 268 and the inner surface of top wall 246 may be utilized.

In operation, the initiator 262 is responsive to an externally generated electrical signal for producing a burst or quantity of energy which will cause the ignition material 260 to rapidly ignite. This will cause hot gases to flow through the ports 270 into the generator chamber 264, thereby causing the generant material 268 to rapidly generate a quantity of gas, preferably an inert gas, which will exit the ports 272 into the second section 230 of chamber 220, for driving the piston 232 as previously described.

It will be seen that the gas generator 240 is coupled with the enclosure 212 by means of an outwardly projecting mounting flange 280, which extends generally radially outwardly of the gas generator 240. In the illustrated embodiment, this mounting flange 280 is formed as an extension of the bottom wall 244 of the gas generator 240 and has a number of through apertures for accepting suitable fasteners 282 to couple the same to an external surface of the enclosure 212 on its second wall 216. In this regard, the second wall 216 may also be provided with aligned openings which may be tapped

to mate with fasteners 282 to accomplish this interconnection. Cooperatively, the second wall 216 may be provided with an enlarged, generally centered opening 284 to receive the outer wall 248 of the gas generator 240 therethrough such that the exit ports 272 communicate with the second section 230 of the chamber 220, and such that the mounting flange 280 abuts and aligns with an outer surface of the second wall 216 of the enclosure 212. Suitable sealing means such as an annular O-ring 286 may be interposed also between the bottom wall 244 and second wall 216. The bottom wall 244 will be seen to be formed with a short, generally cylindrical upwardly extending skirt portion which terminates in the radially outwardly extending flange portion which also provides a surface for accommodating the O-ring 286.

Referring now to the remaining drawings, two further forms of gas generators might be used in place of the gas generator 240 described above without departing from the invention. Indeed, any suitable form of gas generator or gas generator-like device which produces a quantity of gas or other fluid under pressure for driving the piston 232 in the fashion described above might be utilized without departing from the invention.

Fig. 3 illustrates a gas generator ignition assembly using a projectile of the type which is illustrated and described in U.S. Patent No. 5,230,531 which is incorporated herein by reference to the extent relevant. Thus, the structure and operation of the gas generator of Fig. 3 will not be described in detail herein.

Briefly, however, the gas generator of Fig. 3, which is designated generally by reference numeral 300, utilizes a container 310 in the form of a tubular bottle, cylinder or tank of the type often utilized for storing pressurized gas. An end part of the container 310 is provided with a fitting 320 in which there are formed a plurality of gas exit ports 330. Suitable means may be utilized to assure communication of these gas exit ports 330 with the second section 30 or second section 230 of the chamber 20 or 220 of the embodiments of either Fig. 1 or Fig. 2, as described hereinabove.

Referring to the inflator device 300, a quantity of pressurized gas is contained within the container 310. An isolating disc 332 prevents the gas in the container 310 from reaching the exit ports 330. In operation, a suitable detector or sensor device (not shown) will sense a condition requiring operation of the fire suppression device and transmit a corresponding signal to an activation assembly 334. The activation assembly 334 includes an electro-explosive device having a projectile 336. When activated by the appropriate signal, the electro-explosive device propels projectile 336 toward the disc 332 to penetrate and separate the disc to allow gas to begin flowing from the container 310 through the exit ports 330.

A gas generator assembly 340 utilizing a gas generant material 342, for example, similar to the generant material 268 described above with reference to Fig. 2 is also housed generally co-axially within the container 310. This gas generator assembly is provided to augment the flow of gas from the container 310 through the exit ports 330. Further, the heat produced by the combustion of the generant material will serve to raise the temperature, and therefore the pressure, of the stored gas. The gas generator assembly is activated by a change in pressure which is sensed by a bi-stable diaphragm 343 which is mounted in a reference chamber 344 containing a quantity of gas at a predetermined pressure.

As gas flows from the container 310, the pressure experienced on the diaphragm at its surface opposite the reference chamber 344 decreases, since this surface is in contact, via ports 346, with the exiting gas in container 310. Consequently, a central portion of the diaphragm is propelled generally in the direction of the gas generator assembly 340, also propelling and impacting a pin 348 in this direction. The pin 348 is impacted into engagement with a percussion primer 350 to ignite the generant material 342. The gases generated by the generant material 342 then exit its gas generator assembly 340 through a series of assembly exit ports 352 formed in end surfaces thereof, to augment the flow of gas from the container 310.

Referring now to Fig. 4, yet another type of gas generator is illustrated and designated generally by reference numeral 400. Similar to the gas generator 300 of Fig. 3, the gas generator 400 includes a tubular container 410 which contains a quantity of pressurized gas, and preferably an inert gas. The container 410 has an exit fitting 412 which has a plurality of internal ports 414 which communicate with the interior of the container and a plurality of external ports 416 which communicate with the external atmosphere.

As with the inflator of Fig. 3, any suitable means may be utilized to form an operative interconnection for the gases flowing from the ports 416 into the second section 30 or second section 230 of the fire suppression device in order to drive the piston 32 or 232. Also in similar fashion to the embodiment of Fig. 3, a frangible barrier 420 is interposed between the internal ports 414 and external ports 416. This barrier 420 is responsive to a predetermined increase in pressure exerted thereupon from within the container 410 for bursting to allow communication between the respective ports 414, 416 and consequent gas flow outwardly of ports 416.

A compartment 424 is also defined within the container 410 by a partial wall structure 426 having a central opening 428 which is closed by a frangible barrier 430. The compartment 424 contains a quantity of one or more fluid fuels and one or more oxidants to form a volatile mixture. Upon occurrence of a suitable signal from a suitable external sensor or other transducer (not shown), a suitable activating electrical signal is fed to an initiator 432 which extends into the compartment 424. This initiator 432 may be of similar form to the initiator 262 illustrated and described above with reference to Fig. 2. The initiator 432 when thus activated produces

a burst of energy which will ignite the volatile mixture in the compartment 424, in turn bursting the barrier 430 and expelling additional pressurized gas into a gas storage portion 415, defined within container 410, and outside of wall structure 426. The consequent rise in pressure will in turn cause fracturing of the barrier 420 to cause the pressurized gas, augmented by gas flow from the volatile mixture in chamber 424, to flow outwardly through the external ports 416.

A suitable fluid fueled gas generator which might be utilized as the gas generator 400 is more fully illustrated and described in the co-pending U.S. patent application Serial No. 08/252,036 filed May 31, 1994 under the assignee's docket number 2525-21-00 which is incorporated herein by reference to the extent it describes such a device.

What has been illustrated and described herein is a novel and improved, self-contained water mist fire suppression device. Preferably, the device is driven by a gas generator or gas generator-type device, although other means of driving or powering the fire suppression device might be utilized within the scope of the invention as defined by the claims herein.

Claims

1. A fire suppression device (10) comprising:

    an enclosure (12) having spaced, opposed end walls (14, 16) and a side wall (18) joining said end walls to define a hollow chamber (20) within said enclosure;
    an atomizing nozzle (22) operatively coupled to a first of said end walls (14) and having an entrance portion (24) adjacent said chamber and an outlet (25) in communication with atmosphere outside of said enclosure;
    a frangible barrier (26) interposed between said nozzle entrance portion and said chamber and responsive to a predetermined pressure for fracturing to permit communication between said nozzle entrance portion and said chamber;
    a piston (32) located between said end walls and engaged about an inner periphery of said side wall (18) to divide said chamber into a first section (28) between said piston and said first end wall (14), and a second section (30) between said piston and a second said end wall (16), said first section being filled with a quantity of water and comprising a major fractional portion of the volume of said chamber; said piston being slidably moveable relative to said side wall in a direction toward said first end wall in response to a force exerted thereupon for exerting pressure upon said quantity of water for initially fracturing said frangible barrier (26) and for thereafter delivering a water mist through said atomizing nozzle; and
    a gas generator (40) communicating with said second section (30) for raising the pressure within said second section and thereby exerting said force upon said piston.

2. A fire suppression device (210) according to claim 1 further including a tubular conduit (250) extending between said atomizing nozzle (222) and said second section (230) of said chamber (220) for delivering a portion of a gas generated by said gas generator (240) to said nozzle for propelling water through said nozzle.

3. A fire suppression device according to claim 2 wherein said tubular conduit (250) comprises an elongated member having a first end (251) comprising an outlet (225) at said nozzle (222), and a second end (253) comprising an inlet extending into said second section (230) of said chamber, and wherein said atomizing nozzle includes at least one venturi (252, 254) having one end intersecting said tubular conduit adjacent said first end, and another end (224) comprising said nozzle entrance portion, and wherein said frangible barrier (226) is interposed between said first section (228) of said chamber and said nozzle entrance portion.

4. A fire suppression device according to any preceding claim wherein said frangible barrier (26) comprises a burst foil.

5. A fire suppression device according to any preceding claim, wherein said gas generator (240) includes a quantity of gas generant material (268) responsive to a predetermined burst of energy for rapidly generating a quantity of gas, and an initiator (262) responsive to a predetermined external stimulus for producing said predetermined burst of energy in said housing.

6. A fire suppression device according to any preceding claim, wherein said gas generator (240) comprises a housing (242) having an exit port (272) in communication with said second section (230) of said chamber (220), and gas generating means (268) in said housing for generating a quantity of gas in response to a predetermined stimulus.

7. A fire suppression device according to claim 6, wherein said gas generator (300) further includes a quantity of pressurized gas in said housing (310), an isolating disc (332) interposed between said quantity of pressurized gas and said exit port (330) and responsive to a predetermined force for fracturing to permit communication therebetween, and an initiator (334) in said housing responsive to a predetermined electrical impulse for exerting said pre-

determined force upon said isolating disc for releasing said quantity of inert gas from said housing into said chamber (20).

8. A fire suppression device according to claim 7, and further including a gas generator assembly (340) within said housing (310), said quantity of gas generant material (268) being confined in said assembly and responsive to a predetermined stimulus for producing a quantity of inert gas, a primer (350) in said assembly for producing said predetermined stimulus in response to a change in pressure as gas is released from said housing, thereby supplementing the quantity of gas released from said housing with a quantity of gas generated by said gas generant, and heating said pressurized gas.

9. A fire suppression device according to any one of claims 1 to 6, wherein said gas generator (400) includes a housing (410) having an external port (416) in communication with said second section (30) of said chamber (20), a compartment (424) containing a quantity of a fluid fuel material and a quantity of oxidizer material, which fluid fuel and oxidizer when ignited will produce a quantity of inert gas, and a gas storage portion (415) containing a quantity of pressurized gas; a barrier (420) interposed between said gas storage portion and said external port and responsive to a first predetermined pressure for fracturing to permit gas from said gas storage portion to exit said external port, a barrier (430) interposed between said compartment and said gas storage portion and responsive to a second predetermined pressure for fracturing to permit mixing of said gas generated by said fluid fuel material and said oxidizer material with said pressurized gas so as to produce said first predetermined pressure for fracturing said barrier between said compartment and said portion, and an initiator (432) responsive to a predetermined electrical impulse for igniting said fluid fuel and oxidizer to produce said second predetermined pressure, and thus producing said first predetermined pressure for fracturing said barrier between said portion and said external port.

Fig. 1

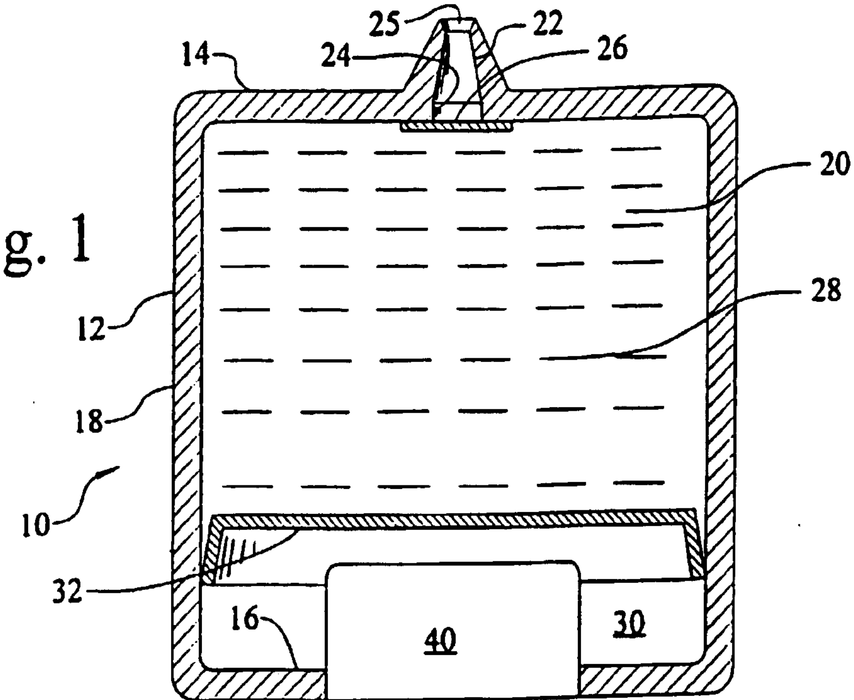
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Fig. 2

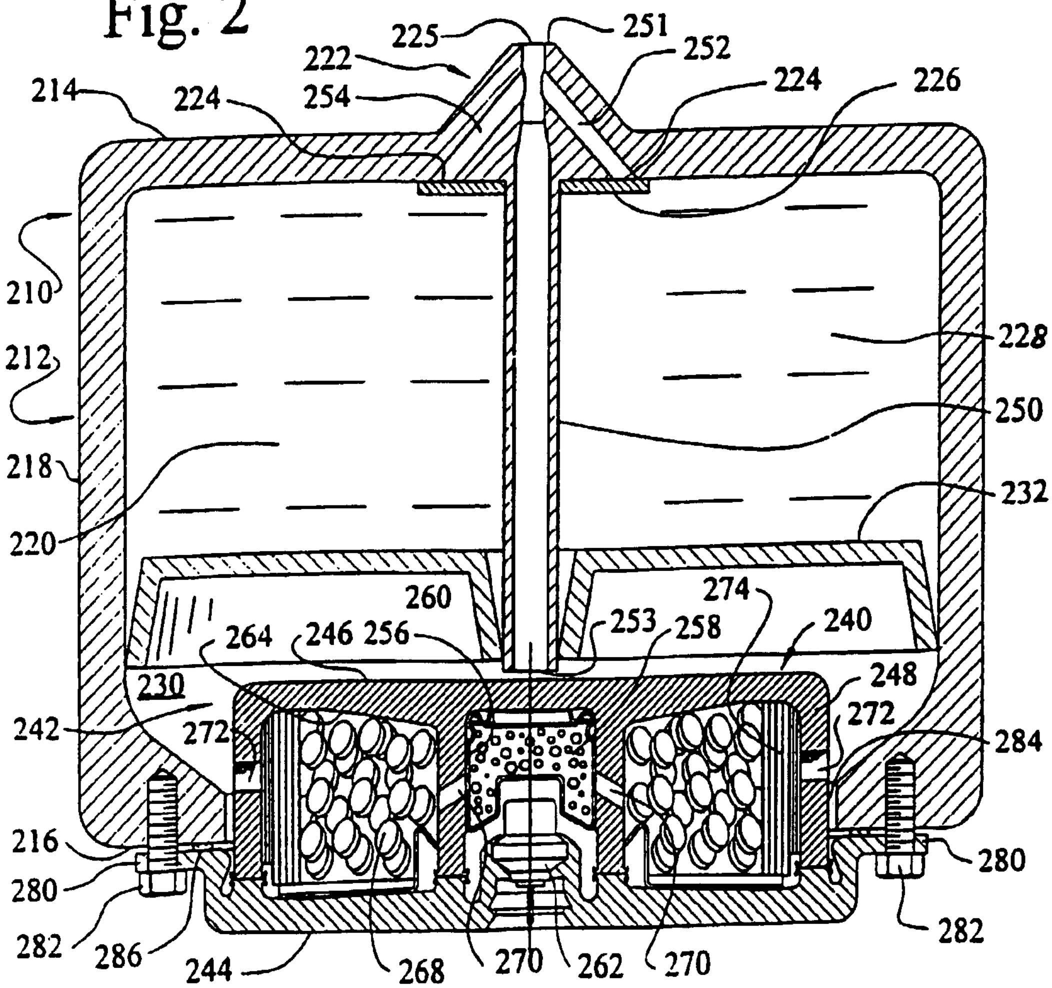
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Fig. 3

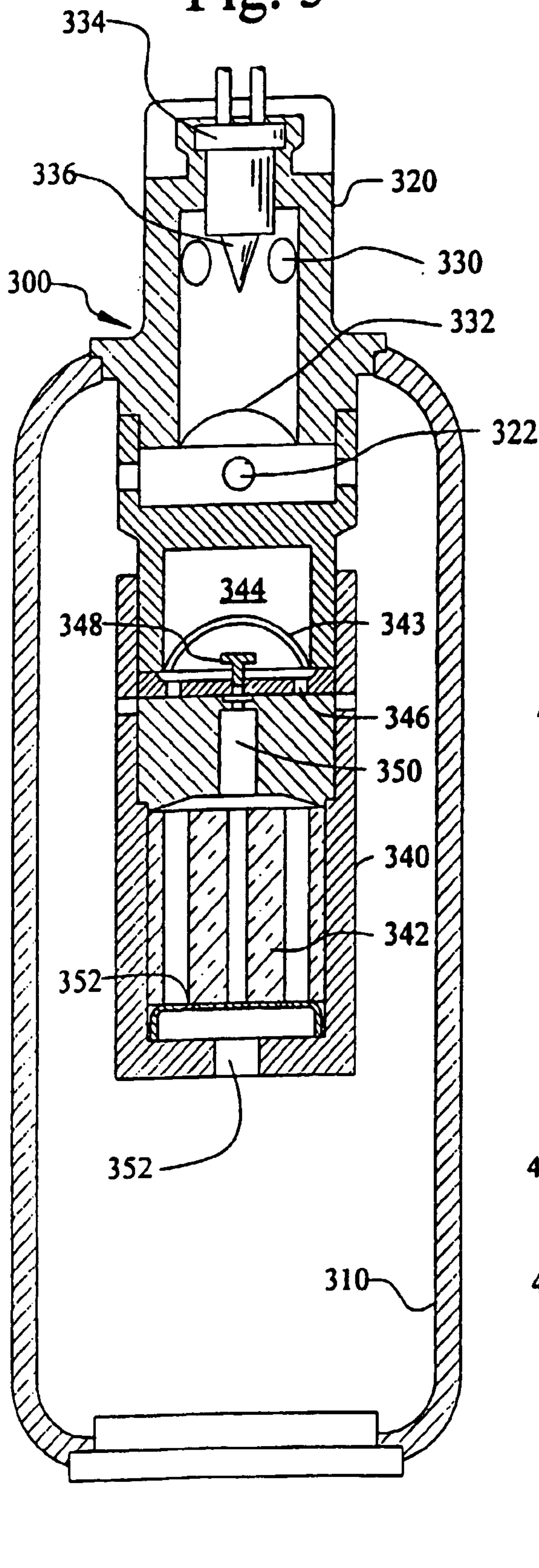
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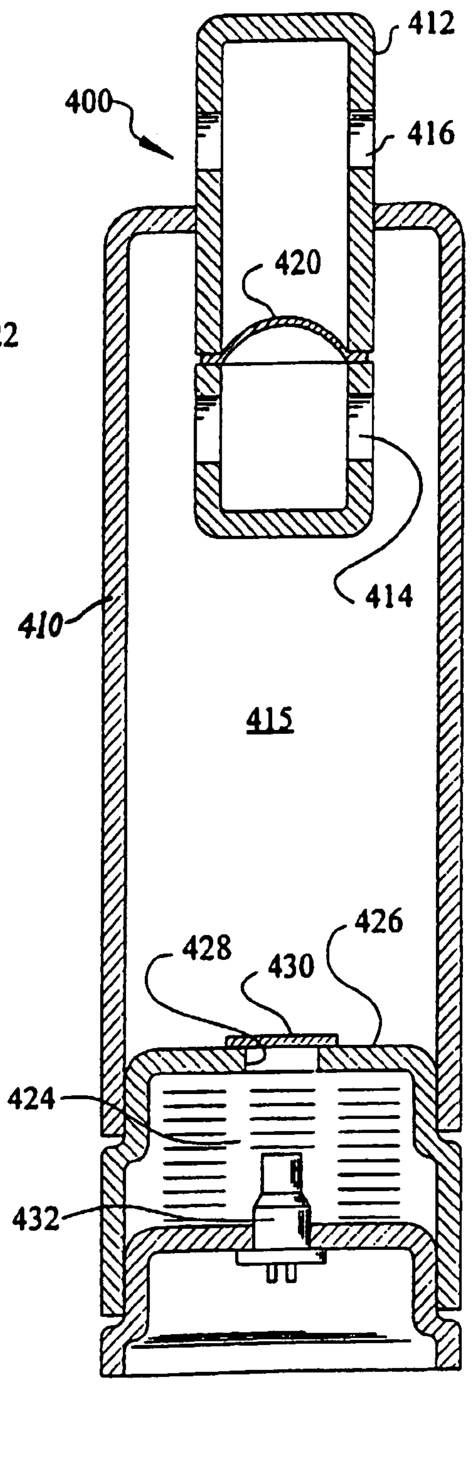
Fig. 4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